University of Missouri

Columbia

FACTOR ANALYSIS

of the

MINNESOTA TEACHER ATTITUDE INVENTORY

by

John L. Ferguson

in collaboration with

Kenneth B. Brown,
Associate Project Director

and

Robert Callis,
Project Director

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The Problem

The present report, the second in a series, is concerned with the investigation of the Minnesota Teacher Attitude Inventory (MTAI). Initially the hypothesis was made that teacher-pupil relationships, as measured by the MTAI, are composed of several aspects or factors, and that these factors may be differentiated in terms of pyschological variables.

In the preliminary work a cluster analysis of the MTAI was made in which 11 clusters of items were obtained (2). These were derived through a modification of a procedure proposed by Wherry and Gaylord (7). This procedure is an iterative process of clustering items with respect to their internal consistency where the clusters will approximate the factor structure of the test. Attempts by members of the staff were made to identify the clusters by inspection of the items assigned to each. But it was found impossible to assign psychologically meaningful labels which would distinguish the clusters.

The second phase of the investigation, reported here, was a factor analysis of the clusters along with tests of know psychological content. The latter were included to aid in the interpretation or differentiation of the clusters in terms of psychological variables.

The Factor Analysis

General procedure of the test administration and scoring. In addition to the MTAI, a test battery was administered to a group of students enrolled in practice teaching at the University of Missouri during the Fall term, 1952-53. The battery consisted of tests selected with the expectation that they would contribute to the interpretation.

The sample. The sample was made up of 46 students engaged in practice teaching in the high school division and 71 students teaching in the elementary division of the University of Missouri Laboratory School. These two groups were combined in the analysis to yield a total of 117 out of 124 students enrolled in practice teaching. The 7 students did not complete the test battery during the administration periods. Of the 117 cases, 91 were women and 26 were men.

The test battery. In addition to the MTAI, the tests administered to the student teachers were:

a. SRA Primary Mental Abilities (PMA), Ages 11-17, Form AM (6)

b. A Test of Fact and Principle in Human Growth and Development (HGD) (4)

c. Guilford-Zimmerman Temperament Survey (G-Z) (3)

Scoring. With the exception of the MTAI each test was scored on all scales with the published scoring keys. Scoring keys used on the MTAI were those based on the final assigment of items to clusters. In addition to the eleven cluster scores a residual score, a total score, and validity scores were obtained.

The two validity scales were developed from an original validity scale constructed by Callis (1) to detect haphazard answering on the MTAI. Callis constructed his scale by scoring those response categories which were selected by 10 per cent or less of the subjects in each of seven different groups. From an inspection of those items with response categories indicating undesirable attitudes toward students, 61 items were selected to form Validity Scale A. A further analysis of Scale A indicated a group of 22 items that were considered even more undesirable, by the investigator, and these were designated Validity Scale B.* Although high scores on these two scales could be the result of careless or haphazard answering, it is logical to suppose that they may represent the true attitude of the teacher toward children, and these scales might better be called "negative attitude scales."

*A list of the items scored on the Validity scales may be found in Fergusen, J. L., Factorial study of the MTAI, unpublished doctoral dissertation, University of Missouri, 1953.

The intercorrelation matrix. Product-moment correlations were computed from the scores obtained by the group of 117 student teachers.

An inspection of the intercorrelation matrix was then made to determine if any of the subtests could be dropped from the analysis without sacrificing any useful data necessary for the interpretation of the clusters. This was done to simplify the work. This inspection indicated that seven of the subtests could be excluded. Low correlation with all of the MTAI clusters and/or inappropriateness of the test to provide meaningful data for the interpretation of an instrument designed to predict teacher-pupil relationships were the most frequent reasons for dropping a subtest. The subtests dropped were PMA-Space, Reasoning, Number, and Word Fluency; and G-Z General Activity, Restraint, and Masculinity. The latter subtest was dropped due to the difficulty of using it with a mixed sample, since on this particular subtest a high score indicates masculinity and a low score femininity.

The reduced intercorrelation matrix containing the remaining 24 variables is shown in Table 1. This matrix was used in starting the factoring process.

Extraction of factors. The factor extraction process was stopped after seven factors were extracted by Thurstone's (5) centroid method of successive extraction of orthogonal factors. After six factors were extracted it appeared that the residual matrix contained only error variance. This was checked by first extracting the seventh factor and attempting to relate meaning to it in the rotational process, and secondly by determining the distribution of residual correlations after the sixth factor was removed. This distribution approximated the normal curve with a mean correlation of -.005. Since no meaning could be attached to the seventh factor in rotation and the residual approximated the normal curve, it was considered to contain only error variance and was dropped from the analysis.

The correlation residuals, after six factors were extracted, are shown in Table II.

Rotation. The basic considerations guiding the rotations were Thurstone's criteria of simple structure and positive manifold, the known factor content of the reference tests, and psychological meaningfulness. Graphical aids were utilized to provide visual inspection of the test configuration for possible rotations. In all, a total of eight rotations was made. The centroid factor matrix is shown in Table III, the orthogonally rotated factor matrix in Table IV, and the transformation matrix in Table V. For convenience, the rotated factors were designated A, B, C, D, E, and F.

As mentioned previously, tests of known psychological content were included with the expectation that they would contribute to an interpretation of the MTAI clusters. However, the factor analysis showed no significant factor loadings among any of the MTAI clusters and those of the remaining scales in the battery. Hence, the results of the analysis indicate that the inclusion of the additional tests contributed to the interpretation of the MTAI clusters only in indicating what they do not measure.

Although the analysis did not reveal the hypothesized outcome, it did indicate that certain clusters should be considered together. This revealed that the clustering of items was a function of the strength of the expressed attitude of the teacher rather than a function of the content of the items. This suggests that only one content factor or type of attitude is measured by the MTAI, but that the strength and direction of the teacher's attitude toward students could be differentiated.

This relationship was observed after an unsuccessful attempt to again identify or differentiate between the content of the items contained in factors B and D. The factors overlapped so much in item content as to make meaningful separation impossible. Not until the scoring of the responses was investigated did a difference between the factors become apparent.

The MTAI has five response categories varying from "strongly agree" to "strongly disagree." The scoring of responses was empirically derived and resulted in a scoring system such that as many as three response categories might be scored correct. In the inspection of the

TABLE I

SELECTED INTERCORRELATION MATRIX*

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Growth and Dev.	1	-	47	01	-03	08	00	05	23	13	12	33	30	13	21	31	13	13	25	26	26	35	35	-30	-13
MMA - Verbal	2	47	-	-02	-04	05	-06	10	34	27	06	17	04	03	08	13	-04	-07	22	16	12	20	16	-13	-09
G-Z - Attendance	3	01	-02	-	56	45	37	-12	24	19	16	15	07	-04	19	21	16	11	07	04	15	10	15	-03	-03
- Sociability	4	-03	-04	56	-	51	35	12	00	33	05	10	07	16	12	08	17	06	10	-03	18	23	16	05	-09
- Emotionality	5	08	05	45	51	-	51	32	07	38	04	18	07	14	14	11	06	07	17	13	17	25	21	-08	-04
- Objectivity	6	00	-06	37	35	61	-	40	-09	45	-04	20	19	11	07	04	05	01	12	16	10	15	12	-10	-05
- Friendliness	7	05	10	-12	12	32	40	-	02	48	09	22	25	26	11	07	00	-05	12	16	19	17	18	-09	-08
- Thoughtfulness	8	23	34	24	00	07	-09	02	-	09	10	22	28	23	08	09	01	04	17	21	28	08	09	-18	-12
- Personal Rel.	9	13	27	19	33	38	45	48	09	-	10	11	32	02	22	19	13	00	28	50	28	26	28	-25	-22
MTAI Cluster 1	10	12	06	16	05	04	-04	09	10	10	-	32	80	35	91	85	48	21	25	50	85	14	67	05	-45
4	11	33	17	15	10	18	20	22	22	11	32	-	80	43	59	50	52	44	65	65	77	61	81	-43	-22
5	12	30	04	07	07	07	19	25	28	32	32	80	-	43	55	45	52	55	43	63	77	60	77	-42	-23
6	13	13	03	-04	16	14	11	26	23	02	35	43	43	-	15	08	13	40	34	34	35	49	43	-39	-18
7	14	21	08	19	12	14	07	11	08	22	91	59	55	15	-	90	61	34	41	65	71	35	85	-09	-07
8	15	31	13	21	08	11	04	07	09	19	85	50	45	08	90	-	59	30	42	52	64	28	76	-05	-02
9	16	13	-04	16	17	06	05	00	01	13	48	52	52	13	61	59	-	35	22	46	65	37	64	-11	-13
10	17	13	-07	11	06	07	01	-05	04	00	21	44	55	40	34	30	35	-	16	43	49	54	58	-23	-05
11	18	25	22	07	10	17	12	12	17	28	25	65	43	34	41	42	22	16	-	43	49	44	58	-37	-20
12	19	26	16	04	-03	13	16	16	21	50	50	65	63	34	65	52	46	42	43	-	59	44	70	-22	-14
13	20	26	12	15	18	17	10	19	10	28	85	77	77	35	71	64	65	59	49	59	-	59	85	-34	-17
Residual	21	35	20	10	23	25	15	17	08	26	14	61	60	49	35	28	37	54	35	44	59	-	74	-47	-28
Total	22	35	16	15	16	21	12	18	09	28	67	81	77	43	85	76	64	58	53	70	85	74	-	-33	-16
Validity A	23	-30	-13	-03	05	-08	-10	-09	-18	-25	05	-43	-42	-39	-09	-05	-11	-23	-37	-22	-34	-47	-33	-	58
Validity B	24	-13	-09	-03	-09	-04	-05	-08	-12	-22	-45	-22	-23	-18	-07	-02	-13	-05	-20	-14	-17	-28	-16	58	-

*Decimal points have been omitted.

TABLE II

RESIDUAL MATRIX*

Variable		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Growth and Dev.	1	08	-08	-03	01	-02	-01	-07	04	00	-07	-05	00	00	05	-01	00	09	-04	-05	03	08	00	-04
PMA - Verbal	2		-05	02	-04	08	-02	04	06	-08	-07	04	05	-02	-03	-02	-01	06	-03	00	05	02	08	-07
G-Z - Ascendance	3			06	05	-11	11	07	01	03	08	-03	05	02	-04	-03	02	-05	-02	-01	-08	-06	-03	03
- Sociability	4				00	06	-03	-08	-07	03	04	02	-05	-03	-01	02	-07	-03	03	-03	-03	-01	-01	00
- Emotionality	5					-06	01	00	08	-02	-01	-01	03	-02	00	-05	01	01	-03	-03	00	01	-01	02
- Objectivity	6						-02	03	-05	-03	-05	02	-07	-02	01	01	-02	06	03	04	01	01	03	-03
- Friendliness	7							-10	02	06	06	-02	05	00	02	03	02	-12	-05	00	-04	-02	-05	02
- Thoughtfulness	8								-01	00	01	01	00	-02	-04	-01	05	-01	03	04	-05	-01	02	00
- Personal Rel.	9									00	02	00	-01	02	-01	-04	01	-03	-01	-02	-02	00	01	05
MTAI Cluster 1	10										06	-04	-02	04	-05	03	00	-04	02	02	-01	-07	-15	10
4	11											-03	08	02	-03	02	-02	-08	01	05	-02	-02	-04	-05
5	12												-04	04	01	-01	-02	-04	-02	00	04	03	07	05
6	13													-01	-04	06	-06	06	02	02	-01	-04	-02	-07
7	14														09	03	02	01	02	02	-04	-05	04	-09
8	15															00	02	-04	03	-02	03	02	-04	09
9	16																-05	04	02	04	00	-02	-05	-05
10	17																	05	-03	-04	01	-01	00	06
11	18																		00	-01	03	-02	00	-03
12	19																			02	01	02	-03	-04
13	20																				-02	-04	-07	-04
Residual	21																					06	03	-04
Total	22																						-01	08
Validity A	23																							07
Validity B	24																							

*Decimal points have been omitted.

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TABLE III

CENTROID FACTOR MATRIX

Variable		I	II	III	IV	V	.I	h²
Growth and Dev.	1	.40	.26	.15	.28	.18	-.25	.42
PMA - Verbal	2	.24	.16	.28	.34	.35	-.24	.46
G-Z - Ascendance	3	.31	-.43	.20	.09	-.26	-.32	.50
- Sociability	4	.31	-.47	.31	-.18	-.35	-.22	.62
- Emotionality	5	.40	-.45	.41	-.23	-.01	-.11	.59
- Objectivity	6	.33	-.45	.36	-.30	.10	.12	.57
- Friendliness	7	.30	-.15	.25	-.30	.38	.28	.49
- Thoughtfulness	8	.19	.07	.27	.40	.01	-.22	.30
- Personal Rel.	9	.48	-.24	.40	-.11	.27	.16	.56
MTAI Cluster 1	10	.57	-.27	-.49	.45	-.16	.30	.96
4	11	.83	.26	-.15	-.12	.20	-.02	.83
5	12	.77	.24	-.20	-.29	.04	.05	.78
6	13	.44	.27	.14	-.30	-.11	.16	.42
7	14	.74	-.24	-.55	.21	.05	.07	.95
8	15	.68	-.25	-.48	.33	.12	-.07	.88
9	16	.57	-.06	-.41	-.05	-.11	-.09	.52
10	17	.48	.25	-.23	-.25	-.28	-.14	.51
11	18	.58	.21	.04	.12	.24	.09	.46
12	19	.67	.12	-.32	-.09	.10	.13	.60
13	20	.84	.10	-.32	-.14	.05	-.08	.85
Residual	21	.70	.32	.12	-.22	-.21	-.17	.73
Total	22	.91	.10	-.33	-.07	-.03	-.09	.96
Validity A	23	-.46	-.46	-.39	-.11	.18	-.24	.68
Validity B	24	-.34	-.13	-.33	-.26	.34	-.46	.58

TABLE IV

ORTHOGONALLY ROTATED FACTOR MATRIX

Variable		A	B	C	D	E	F
Growth and Dev.	1	-.06	.30	.55	.17	-.03	-.03
PMA - Verbal	2	-.12	.13	.64	.03	.00	.12
G-Z - Ascendance	3	.62	-.10	.24	.21	-.03	.01
- Sociability	4	.77	.01	.04	.08	-.05	.11
- Emotionality	5	.62	.11	.13	.05	.00	.43
- Objectivity	6	.46	.10	-.02	.00	-.05	.58
- Friendliness	7	.04	.25	-.04	-.02	-.01	.65
- Thoughtfulness	8	.06	.01	.51	.08	-.15	-.10
- Personal Rel.	9	.24	.24	.20	.08	-.14	.61
MTAI Cluster 1	10	-.03	-.09	-.05	.89	-.40	.02
4	11	-.03	.71	.17	.51	.03	.18
5	12	.04	.73	-.07	.47	.03	.12
6	13	.11	.59	-.11	.03	-.17	.09
7	14	.01	.13	.01	.96	-.05	.12
8	15	.00	.04	.19	.92	.01	.09
9	16	.14	.28	-.08	.63	.08	-.07
10	17	.18	.54	-.13	.31	.05	-.26
11	18	-.14	.44	.28	.32	-.15	.22
12	19	-.08	.48	-.06	.58	-.02	.12
13	20	.09	.60	.04	.68	.09	.08
Residual	21	.30	.75	.14	.22	-.07	-.10
Total	22	.13	.61	.07	.75	.02	.02
Validity A	23	-.01	-.58	.22	.06	.55	.02
Validity B	24	-.06	-.20	-.01	-.11	.73	-.01

items in the clusters having high loadings in factor B, it was noted that a predominance of "agree" (or "disagree" for negative statements) response categories was most often scored. On the other hand, the factor D clusters were heavily weighted with items on which only the "strongly agree" (or "strongly disagree") response categories was scored correct. This led directly to the interpretation that the two factors are, at the least, expressive or different strengths of positive teacher attitudes.

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TABLE V

TRANSFORMATION MATRIX

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	A	B	C	D	E	F
A	.27	.61	.23	.64	-.18	.23
B	-.54	.64	.12	-.28	-.09	-.45
C	.38	.13	.44	-.65	-.34	.32
D	-.28	-.45	.61	.29	-.46	-.23
E	-.54	.00	.33	.00	.44	.64
F	-.35	.00	-.51	.00	-.67	.42

This inspection of the response category scoring suggested the tentative conclusion that high scoring on factor B is indicative of tolerant, flexible, moderate, practical, and socially acceptable attitudes toward teaching and children. High scoring on factor D appears to be expressive of a crusading, idealistic, inflexible, champion-of-the-oppressed attitude toward teaching and pupils.

Factor E was found to be related in positive loadings only to the two MTAl validity scales. Additional information for identification is made by the negative loading (-.40) of cluster 1 on this factor, since cluster 1 probably represents the expression of the strongest positive attitudes. Thus, identification of this factor is rather straightforward, with a high-scoring person expressing little or no concern for the welfare of pupils and being in favor of practices considered detrimental to the pyschological growth of children.

Although this study was not designed to provide an interpretation of the tests in the battery other than the MTAl, an inspection was made of the loadings contributing to the three non-MTAl factors with a view toward their tentative identification.

The two factors related exclusively to the G-Z Temperament Survey appear to have much in common. Because the tests of the G-Z were based originally on a factor analysis, A and F might be considered second-order factors. Factor A might be labeled "stable assertive" and factor F "stable cooperative." Underlying each of the factors are the elements of objectivity, emotional stability, and interpersonal relations. They appear to be distinguishable on the basis of self-assertiveness versus cooperativeness in interpersonal relations.

The remaining non-MTAl factor C may be most appropriately designated an intellectual variable consisting of verbal reasoning and thoughtfulness, or reflectivity.

In conclusion, it appears that while it is still possible that the MTAl may have distinct content variables which the analysis failed to reveal, the varying strength of the expressed attitudes toward children far outweighs the variance attributable to the item content. In retrospect, it became more understandable, to the investigator, that the apparent lack of item-cluster stability required the need for multiple cluster scoring and thereby increased the relationship between the clusters. Subsequently, the eleven MTAl clusters separated into two factors (B and D) with virtually no overlap in factor loadings.

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Summary

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An investigation was initiated to determine more precisely just what is being measured by the MTAl. The study was designed to first cluster the items into homogeneous groups and then to

subject the clusters to a factor analysis. To aid in the interpretation and differentation of the MTAI clusters, a test battery, composed of tests of known psychological content, was administered to a group of college students engaged in student teaching.

The results of the factor analysis indicated that the clustering of items was a function of the strength of the expressed attitude toward students rather than a function of the content of the items. These strengths of attitudes were designated: strong positive attitudes and moderate positive attitudes. In terms of content, the evidence obtained so far suggests a single positive attitude factor is measured by the MTAI.

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